Teacher's Activity Guide - Grades K-3

Project WET Montana

Water Education for Teachers

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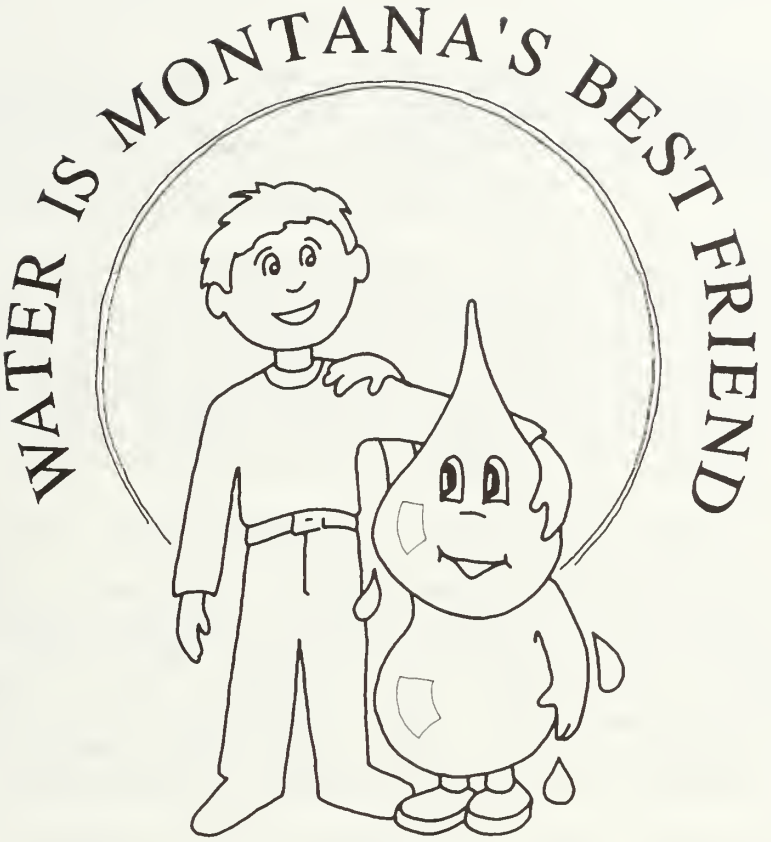

Teacher's Activity Guide - Grades K-3

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State of Montana
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Helena, Montana 59620
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STAN STEPHENS
GOVERNOR

Dear Friend:

It's a great place this state called Montana. She's endowed with a beautiful and diverse landscape. She's home for abundant wildlife, a diverse community of people and Montana offers the best recreational opportunities in America. Much of this is possible because of one important resource: water.

Water is Montana's best friend. It is the valued companion of fishermen and women who pursue Montana's wild cutthroat trout in our blue ribbon trout streams. It is the ally of those who fish for walleye and lake trout in Montana's lakes and reservoirs. Water is unquestionably the best friend of many farmers and ranchers whose crops and pastures would wither without irrigation. Water is the best friend of wildlife. And of us. After all, water sustains life.

This is why the management of Montana's water is so important to our way of life, to our economy and our future. Our administration has made determined commitments to improve our state's standing through the development of a sound Montana State Water Plan. This plan recognizes the need for cooperation between diverse water user groups, and toward the establishment of partnerships with federal and local water managers in our state. How well we manage our water will, to a large degree, determine how well we preserve our quality of life in Montana.

A key element in all this is a clear understanding of the importance of water and the issues involved in its management. I am pleased to have the opportunity to introduce "Water is Montana's Best Friend" to you. This publication provides a valuable insight into water management and the diverse interests involved in making it work. As we discuss these various interests our goal should be to develop a solid consensus about the importance of water and the complexities of its management. Recognizing this we can build a foundation for improved understanding and management of "our best friend:" water.

I want to commend the Montana Watercourse for its outstanding education offerings. "Water is Montana's Best Friend" is another impressive example of these worthy efforts. Congratulations, and best of luck.

Stan Stephens
Governor

Project WET Montana

Project WET Montana is an interdisciplinary, supplementary water education program for Montana youth educators. The goal of **Project WET Montana** is to promote the awareness, appreciation, and knowledge of Montana's water resources through the development and dissemination of classroom-ready teaching aids.

Teaching aids and services available through Project WET Montana include:

Teaching Aids:

Project WET Activity and Reference Guide for Grades K-12
Water Resources Management Simulator
The Ground Water Flow Model Education Package
Liquid Treasure: Montana's Water Resources History Project

Services:

Workshops (Graduate Credit)
In-service Training
Summer Field Workshops
Source of information on Montana water resources and issues
Referrals to sources of water information and assistance
Seminars (3 1/2-hour hands-on overview of program)

For information about Project WET Montana contact:

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Acknowledgments

Project WET Montana Sponsors

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Parts of **WATER IS MONTANA'S BEST FRIEND** were adapted with permission from **WATER IS YOUR BEST FRIEND: CONSERVATION AND RECLAMATION**, California Department of Water Resources.

Affiliation

Project WET Montana is a companion project of a regional water education program called **The Western Watercourse**. **The Western Watercourse** is funded by the United States Department of Interior - Bureau of Reclamation. The goal of **The Western Watercourse** is to facilitate the development and implementation of locally sponsored and administered water education programs. For more information on services and teaching aids available, contact: Program Director, **The Western Watercourse**, Montana State University, 122 Gaines Hall, Bozeman, Montana 59717.

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TEACHER'S OVERVIEW

Teaching about Montana water resources and the importance of water resource management must begin with the basics. That is the foundation of this teachers' activity guide. It is built around concrete or "hands-on" learning that is so essential to the intellectual development of primary-aged children. Incremental experiences have been designed to develop awareness of water as an essential, precious, and manageable resource. It is hoped that concepts learned by your students will produce more water-wise adults.

Tentative answers to questions to be asked by the teacher are furnished only as suggestions to promote the children's thinking, and not as the only responses to a guessing game.

PART I: WATER IS MONTANA'S BEST FRIEND

Introduction

This part is intended to develop young children's awareness of water as a true friend, an abstract concept to be developed through concrete experiences. Simple concrete experiences have been designed for you to convey the internal roles of water in our bodies and in plants.

Activities were selected that address development concepts essential to a child's understanding and developmental level for the 6- to 9-year-old span. In this age span a child is in a concrete stage of learning, just beginning at age 8 or 9 to make transitions to abstract thinking. To small children, abstract is anything they can't see, feel, touch, taste, or smell.

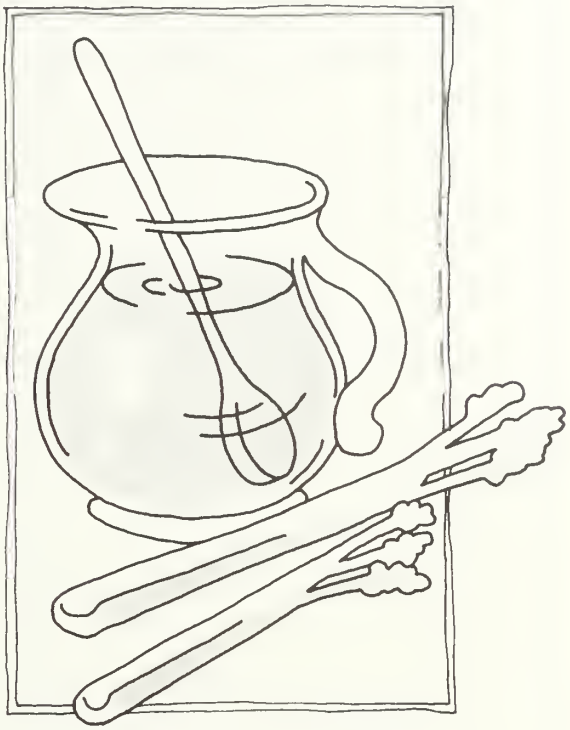
Children are introduced to home and school water use and conservation through direct experiences.

This report includes ideas and concepts which cover all major aspects of the primary school curriculum.

Lesson 1: How do we know water is our best friend?

Key Idea:

We always have water in our bodies. We put it there when we eat and drink.



Activity:

How do we get water inside us? How do we know that it is there?

Materials:

- Celery sticks for snacks
- Extra celery to set aside for Lesson 2
- Package of Koolaid
- Pitcher of water
- Paper cup for each child
- Measuring cup
- Eight water glasses
- Kitchen scale

Procedure:

For the class snack, have a child help you mix and measure Koolaid in front of the class. Serve the Koolaid and celery sticks. After snacks ask the children questions such as: How much water did we use to mix the Koolaid? Why did we use it? *(so we could drink it)* Where is the water now? *(inside us)* How did we put water into our bodies when we ate the celery? *(Celery has water in it.)* How can we show that eating celery gives us water? Weigh the extra celery, label it, and spread it out to dry for several days. (Have the children hold dried celery in one hand and fresh celery in the other, if a scale isn't available.) Ask the children what they think will happen to it; how it may look different. To demonstrate how much water we should take in daily, have a child pour and set out eight glasses of water.

Explain:

This is how much water your body needs every day. Your body gets much of its water from "water you eat." More than half your body is fluid, most of it water (70%); grownups are less "juicy."

Continue the discussion by asking: What did you eat today that was partly water (e.g., milk - 87%, bread - 50%, wheat grain cereal -15%, eggs - 65%, cucumbers - 97%, strawberries - 90%, cabbage - 89%, apples - 80%, potatoes - 78%, fish - 80%, beef - 62%, plants -75%, and bacon - 22%)? How does the water in these foods get into your body? How do you know there is water in your body? How does your skin feel on a hot day, or when you have been running or playing hard? When you cry, where do the tears come from? To extend the children's study of water, you may wish to send home copies of the following letter to parents:

Dear Parents,

Our class is learning about water and why it is our best friend. Your assistance could make our school study more meaningful to your child. Would you help your child become more aware of the following items:

- your home's source of water;
- how water is delivered to your house;
- your different household uses of water;
- where you use the most water;
- your water meter;
- your water bills for different seasons (if available); and
- some ways you conserve water.

If you have additional information for our study, please tell us.

Thank you.

_____

Teacher of Eager Learners

Extension:

How can we show that plants also use water?

Materials:

- Potted plant
- Plastic bag
- Sticks to keep bag from touching leaves
- Tape

Procedure:

Tape plastic bag "tent" over a potted plant. Set the plant in a sunny window and watch water drops form inside the bag. When the condensation is clearly visible, ask: How do we know that this plant has water inside it? *(Small drops of water condense inside the sealed bag.)* Where does the water come from? *(from the plant leaves and from the soil)* How does a plant use its water? *(just as you do, to carry food to growing cells)* When we eat parts of a plant - leaves, stems, fruits, and blossoms - where does the plant's water go? *(into you)* How else do plants give back some of their water to us? (Accept various answers and indicate Lesson 3 Extension will provide the answer.)

Plants, like people, need water to live; plants also store water and slowly release it.

Lesson 2: How does water help us?

Key Idea:

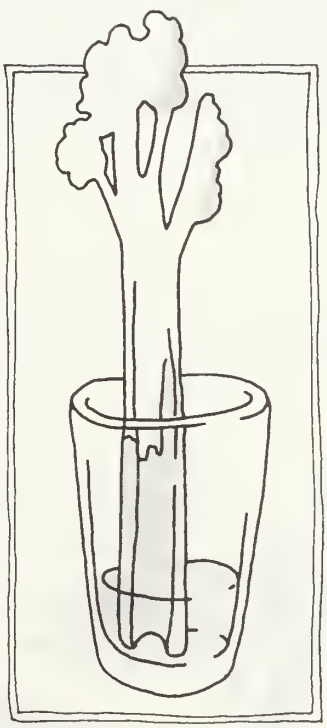
Water is the best carry-all and cleaner for your body.

Activity:

How does water move through your body? *(through veins, arteries, cells, organs)* What does water carry through your body? *(dissolved food and wastes)*

Materials:

- Dried celery sticks from Lesson 1
- Fresh celery stalks set in red food coloring overnight
- Kitchen scale



Procedure:

As the children examine the dried celery, ask: What happened to our celery? *(It looks dried.)* Will it weigh more or less than before? Why? Weigh and compare the dry celery with the celery that was weighed and recorded in Lesson 1. (Have the children hold dried celery in one hand and fresh celery in the other, if a scale isn't available.) How do we know now that celery contains water? Where did the celery keep its water? To show how water moves up from the ground into plants, let the children examine the celery which has been standing in the red solution.

Explain:

The red lines in the stalk show where water travels in plants. These are the plant's "pipelines." Water in the plant's pipelines carries dissolved food from the soil throughout the plant. Let the children now examine plant or weed roots. (optional) Help them imagine how the "pipe system" begins in the tiniest root hairs. These root hairs take in dissolved plant foods and carry them throughout the plant where growing cells need feeding. To help children understand their own "pipe system," have them look at the veins in their wrists. Ask: Can you name other parts of your body's pipe system? *(veins, arteries, tissue, organs, etc.)* How does your pipe system get its water? *(from what you eat and drink)* What would happen if you stopped eating and drinking?

Extension 1:

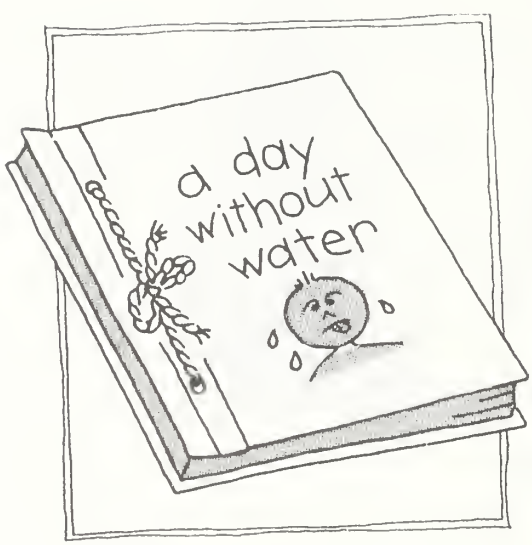
Why do we need water to keep us clean inside and out?

Materials:

- Drawing paper for each child

Procedure:

To help children comprehend all of water's body-cleaning roles, ask: What happens when dust gets in your eyes? *(eyes water)* Where does this water come from? *(tear ducts)* How else does water help clean inside your body? *(saliva, perspiration, wastes)* How many ways do we use water to clean at school? At home? Make a chalkboard list of these ways. Distribute drawing paper for children to fold into quarters and draw four ways water helps us clean things. Make a bulletin board display of the drawings.



Extension 2:

What would we do without water?

Materials:

- Writing paper for each child

Procedure:

Have children dictate or write individual stories entitled "A Day Without Water." Read the stories to the class. So that children may continue to enjoy their stories, assemble them in a book for the class library. Note: This is not a scrapbook - it provides good, meaningful reading.

Explain:

Water is needed to carry food substances throughout our bodies, as well as for internal and external cleaning. Without water children could not "go and grow." Water carries food substances to body cells. Water helps us keep clean inside and out.

Lesson 3: How does water play with us?

Key Idea:

Water is a playmate as well as a helper.

Procedure:

Take the children on a short walk around the school grounds or the neighborhood. Have them think how water makes the area look better. On return, ask: What did you see that needs a lot of water to look good? *(trees, lawn, etc.)* What did you see that needs little water? How do they get water? *(sprinklers, hoses, rain)* What are other ways you like water or use it for play? *(swimming, picnicking, fishing, boating, etc.)* How does water come to some of your favorite water play places? *(stream, pipe, reservoir)* What are some ways you know water is a fun friend? *(It feels good; it is pretty; it cools you.)* How does it play with you? *(It cools you on hot days; it floats you or your boat; it hides fish when you go fishing.)*

Extension:

Why does it feel good to be under a tree on a hot day?

Materials:

- A large tree

Procedure:

Locate the biggest tree on your playground. Have the children walk a wide circle around it along the "drip line." This invisible line is where the outer canopy of tree leaves sheds rain. Tree roots generally reach as far as the drip line and act like a huge sponge to soak up rain. On a hot day a big tree may **evaporate** or release over a thousand gallons of water into the air. Ask children to think why on hot days it is so nice to sit under a big tree or on a green lawn. *(They both evaporate water which cools the air.)*

Summary:
Water is good to use by providing cool shade and recreation through swimming, boating, skiing, skating, etc. Water is a playmate as well as a helper.

PART II: WATER WEARS THREE COSTUMES

Introduction

On Halloween small children love to wear masks and costumes to fool their friends. In this section children become acquainted with water in three different guises, water as a solid (ice or snow), as a gas (water vapor), and in its familiar liquid form.

This constant change of form in nature powers our all-important water cycle. Although seven-eighths of our world is covered with water, we would quickly use up our supply of fresh water were it not for the water cycle (e.g., water, in response to the sun's heat, evaporates from the ocean, rises, cools, and condenses as a cloud, then falls again as rain or snow; snow packs at the Poles and in the high mountains; "banking" accumulated snowfall).

Considering the developmental level of the child in the 6- to 9-year-old span, we feel that an understanding gained through this section about some properties of water will result in a more meaningful introduction to how we can take care of our best friend water in Part III.

Although the properties of water might be regarded as science, one does not have to be conversant with science to try these lessons - only conversant with the thinking, feelings, and perceptions of your children.

Like Part I, this section involves most of the primary grade curriculum and can be handled as part of the normal daily program in your planning.

In each part of the study, you will find utilization of primary level skills for oral and written languages, math and science, art, music and dramatic expression, and health and safety.

Lesson 1: Why do we call water a liquid?

Key Ideas:

Water pours.
Water fits its containers.
Water dissolves some things.
Water is absorbed by some things.
Water has weight.
Water can lift and carry things.
Water washes.

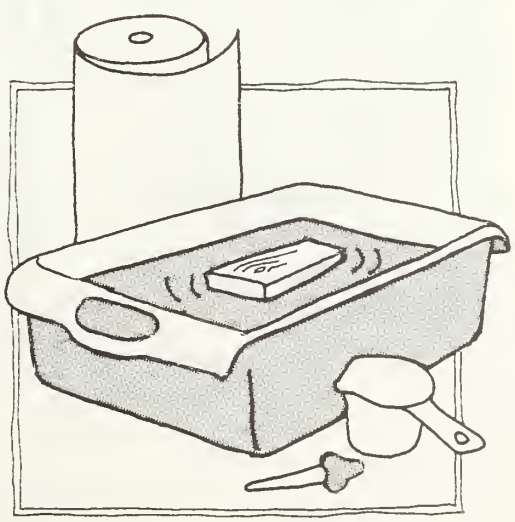
Activity:

What else can water do?

Materials:

For each group of children: (See note in Procedure 1 below.)

- Plastic dishpan or other sizable container of water
- Paper towels and wax paper
- Cloth squares, about 2x4 inches
- Plastic flowerpot holding an inch of rice on top of folded paper towel to cover drainage holes in bottom
- Plastic flowerpot with an inch of soil in bottom
- Small plastic block
- Small wood block
- Food coloring
- Two sugar cubes
- Eye dropper
- Plastic measuring cup
- 3 tablespoons of vegetable oil



Procedure 1:

Set up several areas in the classroom, each having a set of the above materials. Divide children into small groups. Allow time for the children to see how many things they can discover about water, using the materials available. Reassemble the class and discuss discoveries. For example, ask what happened to water dropped or poured on paper towel, wax paper, cloth. What happened to water poured over rice? *(nothing)* Through soil? (turned *muddy)* What happened to food coloring, sugar cubes, vegetable oil, plastic or wood block after being placed in water? Introduce the word **liquid**. Write it on the

chalkboard and ask: What other liquids do we know? How can you tell something is a liquid? How might we use water left over from our discoveries? *(to watch how water behaves on other materials, to clean up)*

NOTE FOR PROCEDURE 1: Depending on the group, the teacher may wish to select a small group of children to demonstrate the procedure as a model for the class to follow.

Procedure 2:

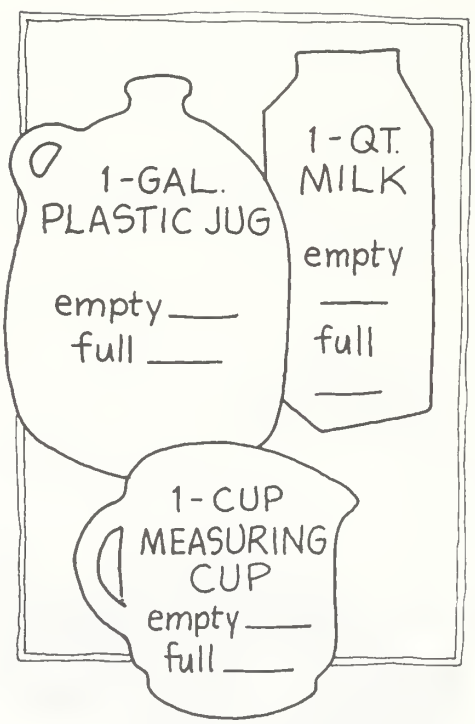
Record the children's discoveries on a class chart or by having the children write individual or group discovery stories. Individual stories may be stapled together for a class library book for spare time rereading.

Extension:

How heavy is water?

Materials:

- Kitchen scale
- Measuring cups
- Clear container



Procedure:

In Part I, the children saw that eight glasses of water are the recommended daily intake. Weigh an empty container capable of holding eight glasses of water. Fill the container with water and weigh again. (Since the children perceive both air and water as transparent, an inflated clear balloon or air-filled plastic bag may also be weighed. Weigh another balloon or bag full of water.)

Weigh an empty quart milk container, an empty plastic gallon jug, and several empty measuring cups (different sizes). Fill each of the containers with water and weigh again.

Make a bulletin board display of cutouts of the different containers and recorded weights. Discuss the relationship between sizes and weights.

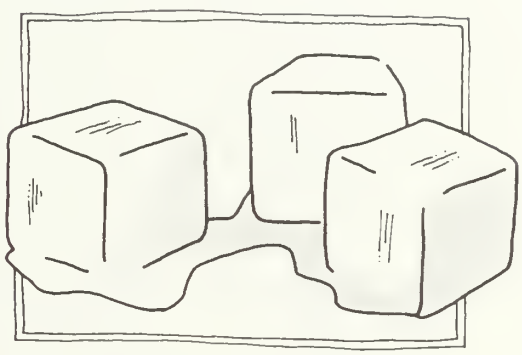
Lesson 2: What turns water into ice?

Key Idea:
Colder temperature makes water turn into ice by slowing molecules.

Activity:
Why does ice melt?

Materials:
- One ice cube per child
- One paper towel per child

Procedure:
Distribute materials and ask the children to examine and explore their cubes. What happens if you squeeze hard? *(some melting because of warm fingers and pressure)* How did the water in the cube get so hard? So solid? How is solid water different from liquid? (See Key Ideas for Lesson 1: Why do we call water a liquid?) Touch and name some other solid things around us. *(floor, walls, furniture)* List some other common solids. Why is water a special kind of solid? *(Ice melts readily, can be refrozen and stored, melted, and reused without losing much of its original quantity.)* How could we prove this? *(Put some water back in the freezer.)* How can you make water freeze faster or slower? *(Change the temperature of the refrigerator.)*



Extension:
Which kind of water is heaviest, liquid or solid?

Materials:
- A tray of ice cubes
- A tray full of water
- Kitchen scale

Procedure:
Weigh each form of water. Why is the solid heavier? *(Molecules are more compact.)*

Summary:
When water gets very cold, it turns into solid form. What if water didn't turn into ice or snow? How is ice or snow a kind of water "bank"?

Lesson 3: When does water turn into a gas?

Key Idea:

When water gets very warm, it turns into water vapor (a gas).

Activity 1:

How do we know there is moisture in our breath?

Procedure:

Exhale close to the chalkboard so that moisture from your breath makes a dark, wet spot. Trace the spot with chalk and ask why the spot is darker than the rest of the board. Where did the moisture come from? *(inside the lungs - Moist lung tissue allows gases in the air to dissolve and pass in and out of our bodies.)* Fan the spot to make the molecules move faster and watch it disappear. Introduce the word **evaporation**. Write it on the board and clap out the syllables as children say it. Discuss the root word **vapor**. What are some ways you can make water evaporate or jump into the air? *(heating, boiling)* If you have a bad chest cold, how does your parent make steam to help you feel better? *(heating water in a vaporizer)*

Activity 2:

How does evaporation help us when we paint?

Materials:

- Paint paper for each child
- Watercolors and brushes
- Small water containers
- Sink stopper

Procedure:

Have the children paint a picture of their favorite water play activities. To show how much water is used for paint cleanup, stop up the sink before children wash hands, brushes, or water cups. Then follow with class discussion on how water was used. How did we use water to mix our paint and spread it? How much water did we use to clean up? How might we have used less? What became of the sink water when we pulled the stopper? What if the water we used to paint did not evaporate?

Activity 3:

Where did the water go from our paintings?

Materials:

- Children's pictures from previous activity
- Clothesline
- Clothespin for each child

Procedure:

To share the paintings, string the clothesline across the chalkboard at the children's eye level. As the children finish, let each child hang his/her picture with a clothespin. Allow time for the children to walk by and enjoy each other's pictures. Then ask: What kinds of "playing with water" do our pictures show? Where do you go for this kind of water play? Where did the water go that we used to mix our paints?

When we made water very cold it became a solid. When water is spread out to dry, as in our pictures, it evaporates or turns into an invisible gas, water vapor. Some of the tiny drops which jumped into the air are still around us even though we can't see them. What if water didn't like to jump away and hide when it gets too warm? *(There would be no water vapor to make clouds for rain or snow.)*

Extension:

Why do some things dry so much faster than others?

Materials:

Three or more cloth samples of different thicknesses or textures (nylon, cotton, etc.)

Procedure:

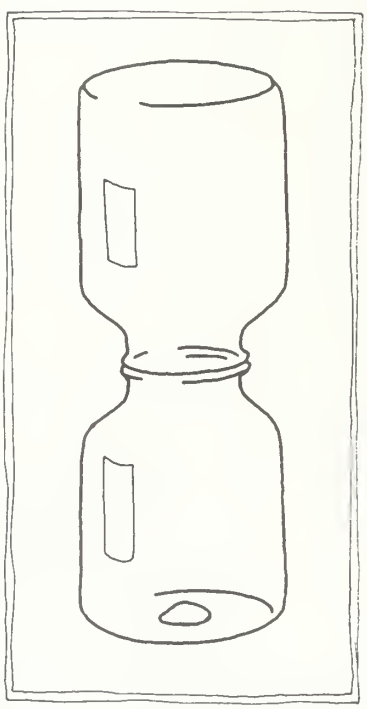
Which of these will dry fastest? Slowest? Ask for volunteers to wash (rinse) the samples and hang them out to dry. Keeping track or drying time might be an interesting record for some. Examining cloth with a magnifying glass might interest others. The weave and texture under magnification is surprising. What is the best time of day to dry things outdoors? *(daylight)* Why? *(Sun's heat is greatest.)* What is the worst time of day to water plants outdoors? *(night)* Why? *(The plants remain wet through the night, resulting in a condition favorable to certain plant diseases. If you are trying to reduce the amount of water lost to evaporation, early morning watering is recommended.)*

Lesson 4: How does water vapor change into liquid water?

Key Idea:
Water becomes an invisible gas and returns to a liquid.

Activity:
"Now You See It and Now You Don't." How can we make water go away and come back?

Materials:
- Two glass tumblers or clear jars
- Small amount of colored water
- Eye dropper
- Sticky tape
- Bowl containing about an inch of ice water



Procedure 1:
To demonstrate for the class, put one drop of colored water (for visibility) in the bottom of a glass. Tape the other glass on top, closing the gap carefully. Set the glasses in a warm place (e.g., a sunny windowsill or near a radiator). Ask questions such as: What do you think will happen to the water in the jar? If it disappears, where could it have gone? *(into the air in the jar, as water vapor)* How do you think we might get the drop out of hiding (in the air)?

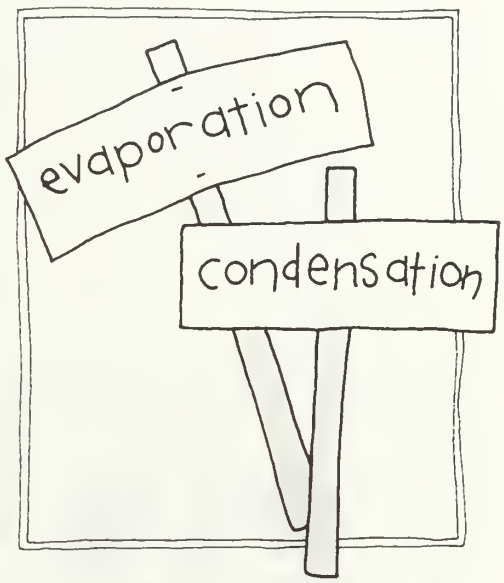
Procedure 2:
When the drop has evaporated (disappeared), discuss the children's suggestions for bringing it back. When cooling is suggested, set the glass in the bowl of ice water. Since our water drop likes to hide, we may have to wait 10 to 15 minutes. While waiting, ask: What made our drop of water jump into hiding? *(warm air)* When liquid water turns into water **vapor**, what word do we use? *(evaporation)* Recall use of the term in Lesson 3. What are we using now to make the water drop come back? *(cooling)* What does cooling do to water vapor? *(It makes the tiny particles or molecules condense or get closer together.)*

Introduce the word **condensation** by writing it on the board. Then say it together and clap out the syllables. Repeat the illustration (Lesson 3) of condensation-evaporation by asking a child to exhale on the blackboard

or window. Outline the dark spot made by moisture from the breath. Ask children to breathe out. Why doesn't this moisture show now? *(The water droplets jump away into the air around you.)* What made them show on the blackboard as a dark spot? Ask a child or two to touch the blackboard, then have them hold their hands in front of their mouths. Which is cooler? *(the blackboard)* What did we do to our glass to bring back the water drop? *(We cooled it with ice water.)*

Extension 1:

How could we act out **evaporation** or **condensation**?
Ask your friends to guess which you're acting out (e.g., fanning something - evaporation, or blowing on a window - condensation).



Materials:

- A piece of paper for each child

Procedure:

Children fold the sheet in half. Label one half **condensation,** the other, **evaporation**. Let individuals or small groups plan and act out an activity to demonstrate one or the other. The other children hold up the correct word on their papers to show they recognize the process being shown.

Extension 2:

Children may enjoy acting out liquid water molecules, walking about in a small group. Others may act out water vapor molecules, moving faster (e.g., running on the playground). Ask: How would you act out water molecules in snow or ice? *(standing close together, moving slowly)*

Summary:

Cooling invisible water vapor slows the molecules and brings them back in a more condensed form as liquid water (condensation). Heating liquid water speeds up the molecules, spreading them further apart and making them invisible again (evaporation).

Lesson 5: What is the water cycle?

Key Idea:

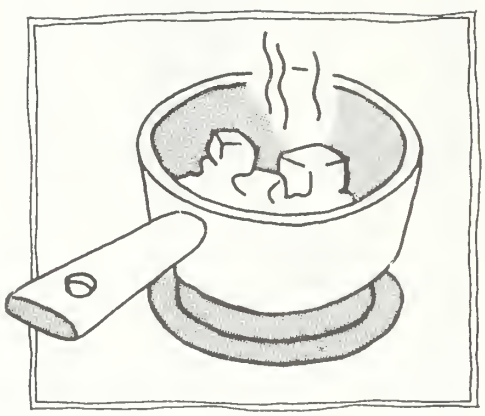
Water changes to water vapor as the surrounding temperature rises. As the temperature drops, water cools back to a liquid, and may cool still further to form snow or ice. With an increase in temperature, water warms back to a liquid. Water is constantly changing in a never-ending cycle without which we would quickly run out of water.

Activity 1:

How can we use water to make a cloud?

Materials:

- Hot plate
- Saucepan
- Ice cubes



Procedure:

Put the ice cubes in a saucepan on the hot plate. As the children watch the ice melt, ask: What is making the ice turn back into water? *(warmth)* If we let the water from melted ice boil, what third form will water molecules take? *(water vapor)* As the water vapor rises, will it get warmer or cooler? *(cooler outdoors)* The children may wish to share their experiences of cooler air in the mountains.

If our water vapor flies very high where it is cooler, would it condense or evaporate? *(condense as it cools)* If you see a cloud, would water drops have condensed or evaporated to make the cloud? *(condensed)* If we could catch a cloud and freeze it, what might we make? *(snowflakes)* Some of the clouds we see in Montana make rain because the tiny water droplets in those clouds join hands to make rain. (The water droplets became cooler as they rose, slowed, moved closer together, became heavier, and fell.)

Write these sentences on the board or read aloud. Ask children to complete them.

"Warmth makes water _____." *(evaporate)*

"Coolness makes water _____." *(condense)*

Extension 1:

How do water droplets join hands to make rain?

Materials:

- A cup of Koolaid or thin paint
- Aluminum foil pans or small sheets of foil
- Drinking straws

Procedure:

Demonstrate for the children how to use straws to put drops of liquid on the foil. Use the straw to push the small droplets together to make big, heavy drops. When the drops in a cloud get big and heavy enough they are apt to fall as rain.

Extension 2:

What are some different cloud forms? (If possible, use this activity on a cloudy day.)

Materials:

- "The Cloud Book" by de Paola, Scholastic Book Services, 1975, or other picture storybooks on clouds
- Light blue construction paper
- Cotton and paste

Procedure:

Are all clouds the same? *(no)* Ask children to describe some they have seen. Show pictures of four main types: cirrus, cumulus, stratus, and nimbus. Weather permitting, let the children make pictures of clouds they see outdoors, using cotton pasted to blue background. Later, display (as in clothesline walkby, Lesson 3).

Activity 2:

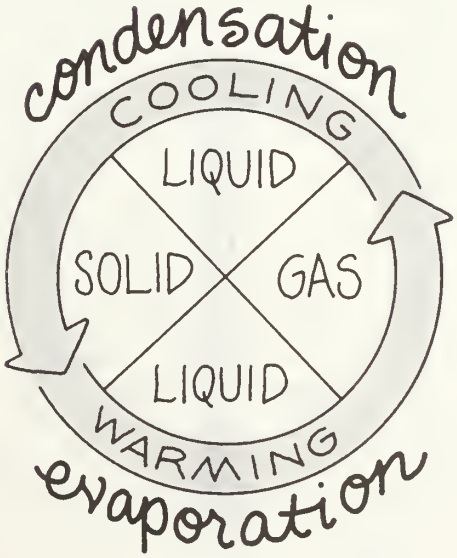
What makes the water cycle go around and around?

Materials:

- Drawing paper for each child
- Chart of water cycle enclosed for drawing reference on Procedure 1. Display during Procedure 2.

Procedure 1:

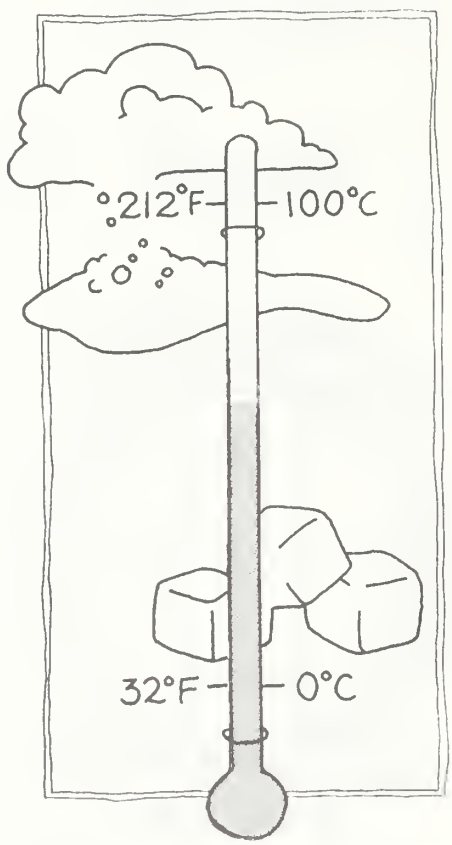
Draw a large circle on the blackboard and label as shown. Where on this circle do you see the label for solid water? What can change it to a liquid? Where do you see the label



for water as a gas? What can change it back to a liquid? Where do you see labels for liquid water? What changed in each place on the circle? Ask a child to point out solid water on the diagram, then trace and describe its path. Do the same with water in gas and liquid form. Where are evaporation and/or condensation happening around us every day? *(clothes drying, ice cubes freezing, clouds forming)* What if evaporation or condensation didn't happen around us all the time? What if water was only a liquid? *(no snow, clouds, or rain)* For children to share their knowledge of the water cycle at home, allow time for them to draw and label a copy of the water cycle to take home. Some children may enjoy drawing examples of water's "changes of costume."

Procedure 2:

To reinforce the children's concepts of the natural everyday operation of the water cycle around them, display the enclosed large chart. Ask them to examine the chart to tell where evaporation is taking place and what might cause it. Where would water freeze and why? Where is water heaviest? Lightest? Ask a child to locate on the chart where a raindrop would start and trace its complete path. Follow the same procedure with water as fog or mist, as a snowflake, and as a spring or stream.



Take the children outdoors and have them tell you where they know the water cycle is at work. (Comment: The earth has the same amount of water today it has always had. The earth gets no new supplies from space; the astronauts found a dry moon.)

Extension 1:

At what temperature does water change to a solid? A gas?

Materials:

- Large glass thermometer

Procedure:

Give the children an opportunity to examine the thermometer. Draw a simplified blackboard sketch showing the boiling point (212 degrees Fahrenheit or 100 degrees Celsius) and the freezing point (32 degrees Fahrenheit or 0 degrees Celsius). Point out what the temperature should be when liquid water turns to gas (high or low?); when liquid turns to ice (high or low?); when water changes to ice; and when water changes to water vapor.

Ask the children to estimate outdoor temperatures and to compare them with boiling and freezing points.

Extension 2:

What are some sounds of water?

Materials:

- Portable tape recorder

Procedure:

To afford another opportunity for the children to express their awareness of water in its different guises, ask them to think about a few sounds that water makes.

If you have access to a tape recorder, tape a few sounds of water. Play the sounds back to your class and have them guess what is making the sound. A few examples are: waves washing up on a beach, a dripping faucet, raindrops on a roof, water boiling over on a stove, rumble or roar of a waterfall, whistling teakettle, and the whistle of a steam engine train. Can you name some other examples? (toilet flushing, lawn sprinkling)

Your students may think of other sounds. If possible, record the sounds your students discover and use them in another class.

Summary:

The water cycle is powered by changes in air temperature. Our familiar liquid evaporated into the air to form a gas; the gas water vapor cools and condenses back into liquid; or the liquid cools until it becomes solid ice or snow crystals. These crystals warm and melt back into a liquid, providing rain to replenish our water supplies, and snow to store water for our future supplies.

PART III: TAKE CARE OF OUR FRIEND WATER

Introduction:

A good friend like water deserves our attention and care. Taking good care of our friend requires sound water management practices. Just as this activity guide attempts to teach the basic water principles, the most important aspect of water resource management is accurate background data. The data that is used on a daily basis to make decisions on water problems was gathered through years of field work. Laws have also been developed to protect our friend water. Laws have been written that give government agencies the responsibility of making sure Montana's water resources are managed for the benefit of all its citizens. For example, the Montana State Health Department monitors the state's waters for quality problems. A few of the State Water Commission's responsibilities include: floodplain management, dam safety, and ground and surface water investigations. Other local, state, and federal agencies concern themselves with other aspects of water management.

This section provides simple, concrete experiences to illustrate to young children abstract concepts of water resource management; for example, "making running water walk" with a scaled-down model of a dam or catch basin. Children are introduced to methods of water use at home and at school. They become "detectives" looking for water wasting. They make a classroom model of polluted water and learn how the water can be filtered. A simplified version of the steps involved in water treatment is provided in the preparation for a possible class visit to a local municipal or rural water treatment plant. The children examine and practice ways of water conservation appropriate to their ages and situations.

In conclusion, based on their findings and experiences, children compile a class newspaper on water resource management to read at school and proudly show at home.

Lesson 1: How is water collected and saved for us?

Key Idea:
Water is collected and stored by natural and man-made systems.

Activity:
How does the ground collect and store water?

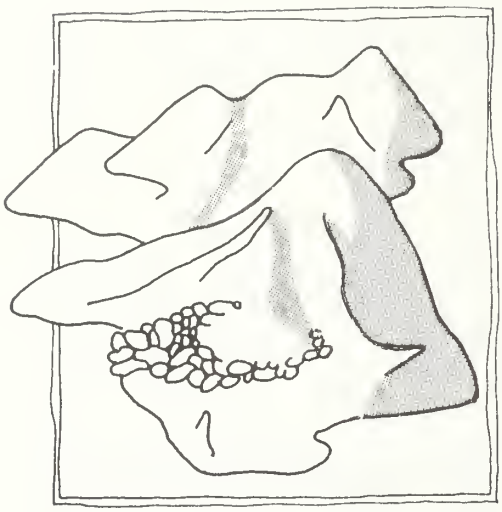
Materials:
- Plastic pot full of soil
- Five small plastic glasses
- Quart of water
- Tray to catch excess water
- Funnel
- Kitchen scale

Procedure:
To show how soil holds water like a sponge, weigh the pot of soil and record the weight on the board. Place the pot on the tray. Fill the plastic glasses with water and select five children to "rain" (sprinkle water) on the pot. Ask: What is the water doing? Where is it going? Will the pot weigh the same or differently? More or less? Reweigh the pot and compare the figures. Why does water move downward through the soil? *(gravity)* Pour the excess water not absorbed by the soil back into the quart container. Did we get all the "rain" back? If not, where did we lose some? Why is soil something like a sponge when it rains? When it rains, which will store the most water? The paved streets, the sidewalks, the packed playground, the garden soil, or the forest soil? How could plants help us save rain? Which part of the plants hold back the most water? *(roots)* Why can soil be called a kind of water "bank"? *(Water is stored in the open spaces between soil particles.)*

Activity 2:
How is runoff water collected?

Materials:

- 2 quarts of water
- Two small watering cans with fine spray heads
- A collection of small pebbles or a bag of soil
- Sandbox or uneven school yard area, 3 feet square



Procedure:

Take the class and the materials to a selected area. En-route, children may collect more pebbles. Explain: Imagine that this area is a miniature model of some place on earth with high and low spots, mountains and valleys. Which spots could be the mountains; which could be the valleys? Next, have two children fill the watering cans and "rain" on the area until the can or one container of water is used up. What is happening to our rain? How much of it ran off? How much soaked in? To make more soak in, help the children select small wrinkles or folds in the surface where low rows of pebbles can be piled across to form small catch basins. Again, try "raining" with the second container and note less runoff and water loss. This simple method has been used for centuries by people living in lands where there is very little rain. Parts of the Sinai Desert receive less than 2 inches a year, yet the inhabitants raise crops on terraces built across the smallest crease in the ground.

In Montana people build dams across streams and rivers to catch and store water in reservoirs. The children may describe dams or reservoirs they and their families have visited (i.e., Canyon Ferry and Fort Peck).

Lesson 2: How is water shared?

Key Idea:

Water comes to you through ditches and pipes from rivers, lakes, storage reservoirs, or underground wells.

Activity:

How does water come to your home and school?

Materials:

- Map of Montana's water system - selected rivers, lakes, and reservoirs. (The map is enclosed with this activity guide.)

In front of the children, use markers or crayons to color:

lakes - green
rivers - blue
reservoirs - red

Procedure:

How does water from so far away reach your home or school? Does a magic fairy put it there? Using the map, explain that this is a map of Montana's water resources. The green areas are natural lakes and the blue lines are rivers. Which can you locate? The red spots are reservoirs built to collect and store water for us. Who can find them? How many can you find? Which one is closest to us? If you remember the celery's pipe system (Part I, Lesson 2), you can tell us how we get water from a reservoir. Some Montana towns and rural areas get their water through rural water systems. Rural water systems operate on the same principle as a city water system where there is a source of water, a well, and pipes that carry the water to users. Does your school, town, or home get water from a rural water system or does your town have its own water system? Some people and places get their water from underground wells, but these wells are too small to show on the Montana map.

Extension:

What is our school's water system?

Materials:

- Sample bar graph for school and home use

Procedure:

If possible, the principal and/or custodian might visit the class to describe the school water system. The children will want to know how much water the school uses in a day, a week, a month, what it costs, and where the water comes from (source of water). Discuss with the children ways of using less water at school; for instance, stopping leaky faucets and other leaky water fixtures. Make a class bar graph showing use of different school water outlets. Each time a child uses a different outlet, he/she colors a square of the graph. After a week discuss the class graph. Ask: Which outlets are used most? Least? Which use the most water? Least? Where is water wasted? How can we save water? *(e.g., installing a shower head that saves water)*

You may wish to duplicate the bar graph for home water "detective" recording.

WATER USE SURVEY

		TIMES PER DAY											
		1	2	3	4	5	6	7	8	9	10	11	12
SCHOOL	SINK												
	TOILET												
	WATER FOUNTAIN												
	OTHER												
HOME	SINK												
	TOILET												
	BATH												
	SHOWER												
	DISHWASHER												
	WASHING MACH.												
	HOSE/SPRINKLER												

Lesson 3: How can we save water?

Key Idea:
Since there is only so much water to go around, we must learn and practice ways to use it wisely.

Activity 1:
What are some ways to save water at home and school?

Materials:
- A gallon jug of water
- A 5-foot piece of yarn or string for each child
- Drawing paper for each child

Procedure:
As the children sit in a circle on the floor, explain: We are going to pretend each of us is a house with people inside. Can you imagine your people, their pets, and their home? How many people are inside you? How many rooms? Which rooms have water outlets? What kind? Pretend this gallon jug is our town reservoir - our whole year's water supply. With the container at the center of the circle, run a piece of yarn from the container to each child. Imagine that these pieces of yarn are water pipes to your house. Imagine the different outlets in your "house." Which one might use the most water? *(toilet)* Which outlet is most apt to waste it? What if someone in your house wastes water? *(costs your family money)*

With the children's help make a chalkboard list of all the ways you use and save water in your "house." Here are a few "starter" ideas:

Brushing teeth: Use water only to wet the brush and for rinsing. Don't let the water run while brushing.

Bathing: Use a timer for a short shower.

Toilet: Flush only as required. (Place a brick in the tank to displace water.)

Tub bath: Use no more water than actually needed.

Leaky faucet: Tighten fittings; replace washer.

Hand laundry: Do not fill the sink or tub in excess of what is necessary for rinsing. (Don't use running water.)

Car washing: Use bucket and sponge; hose only to rinse.

Yard: Don't water the lawn in the heat of the day. (Decrease evaporation.) Water only as much as needed. Don't water sidewalks and driveways.

From the list on the board, have the children choose a water saving idea for a water poster to take home. Some of the children may choose a school water saving idea for a poster (e.g., person fixing a leaky faucet).

Extension 1:

Who wastes water? Who saves it?

Procedure:

After discussing ways to save water, pair up the children to act out a water use. One partner is to show water **saving**, the other water **wasting**. The class tries to guess which is which.

Extension 2:

How can you be a water "detective"?

Procedure:

Encourage the children to find water leaks at school and at home. For example, a few drops of food coloring in the toilet tank will show up in the bowl if the toilet is leaky. Water "detectives" can listen and look for dripping faucets. Collect and measure the water loss overnight and report to adults. Give each student a water detective badge to wear for one day.

Activity 2:

How can we reclaim and reuse water?

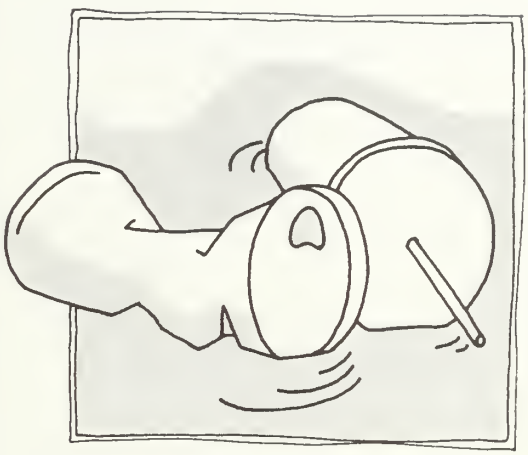
Materials:

Read aloud: "Let's Stop Water Pollution" by Michael Chester, 1969, Putnam, or a similar picture storybook.

Procedure:

If available, books on water treatment and pollution could prepare children for the valuable experience of visiting a local water treatment plant. Explain: Water treatment may involve local water purification and/or water recycling for reuse in lawn watering, play fields, parks, golf courses, and industry.

Water coming into homes and schools must be purified. People responsible for our water supplies are constantly checking to be sure the water is not contaminated before it reaches us.



Water going out of school and home drains may be reused for non-human consumption. Less extensive treatment is needed for water to be used for non-human consumption than water to be used for human consumption.

In either case, the first step is clearing the water of some pollution by filtering. Ask: What is **pollution**? How did we pollute the water we used for painting when we cleaned our brushes? How else do we pollute water at school and at home? *(by washing, bathing, using the toilet)*

When you and your family have gone swimming or picnicking beside a stream or lake, what kind of water pollution have you seen? *(empty cans, trash, picnic wastes, leftover food, etc.)* If you have ever been in a boat or on a ship, have you seen people pollute the water by dumping or dropping things overboard?

Extension:

How could we filter some good water from water polluted with paint, mud, or "junk"?

Materials:

- Quart of water
- Empty quart jar
- Medium or large funnel
- 1/2 cup sand
- Wad of cotton (absorbent)

Procedure:

After the children have mixed paint or mud in the quart of water to pollute it, they can filter and clear it as follows:

Place a wad of cotton in the bottom of the funnel. Cover the cotton with an inch of sand. Set the funnel in the empty jar and gently pour in the "dirty" water. Filtering is the first step to cleaning water for reuse.

Background Information:

Sewage Treatment Plant - In a sewage treatment plant, dirty (polluted) water may go through the following steps: In the primary settling tank, some floating material and most heavier solids are removed. Next, the water goes to the aeration tank where it is sprayed into the air to remove tiny invisible organisms and toxic gases. Next, carbon filters remove pollutants such as pesticides. The clear water moves to a chamber containing chlorine gas. (The children will recall the strong odor and cautions when household bleach is used.) After all of these steps, water is considered ready for reuse, but not ready or safe for drinking. Its uses are limited to those that will not result in human consumption - such as watering golf courses.

Summary:

The earth has the same supply of water today it has always had. The earth gets no new supplies from space, as the astronauts discovered on the moon (dry, dry, dry!). Spaceships and our earth "ship" which are sealed off from space are called "closed systems." Recycling is vital in closed systems. **TO CONSERVE ENOUGH WATER FOR EVERYBODY, WE HAVE TO TAKE BETTER CARE OF THE WATER WE HAVE.**

Activity 3:

How can we make our friends and family more careful with our best friend water, and teach them how to save it?

Materials:

- One 2 1/2x4 inch piece of paper for each child
- Four sheets of duplicating paper
- Parents' letter

Procedure:

Ask the children to try to remember all of the things they have learned about water. Help them by listing the fol-

lowing headings on the board: Water's Three Forms; Uses of Water; and Ways to Save Water. Discuss each and add the children's ideas under the headings. When all of the ideas are listed, suggest that because they have learned water conservation is so important, they should write a newspaper to share their ideas. Let the class select a title for the paper. Have each child select an idea to illustrate or to write about on the small sheets. To assemble the newspaper, paste the completed articles on the full sheet of paper for duplication. To save paper, duplicate on both sides, as in a standard news sheet.

For household saving hints that the children may not have included, you may wish to duplicate the enclosed letter to go home with the "newspaper."

Summary:

To conserve enough water for everybody, we must help the water cycle by taking care of the good water we have in our state.

Dear Parents,

We have just completed our study of water awareness, use, and conservation. Attached is a copy of our own Water Newspaper. We think you'll enjoy it. While our study has culminated for now, we hope your child will continue to be aware of his/her water usage and water conservation at home. Here are some ways other people have found to save water:

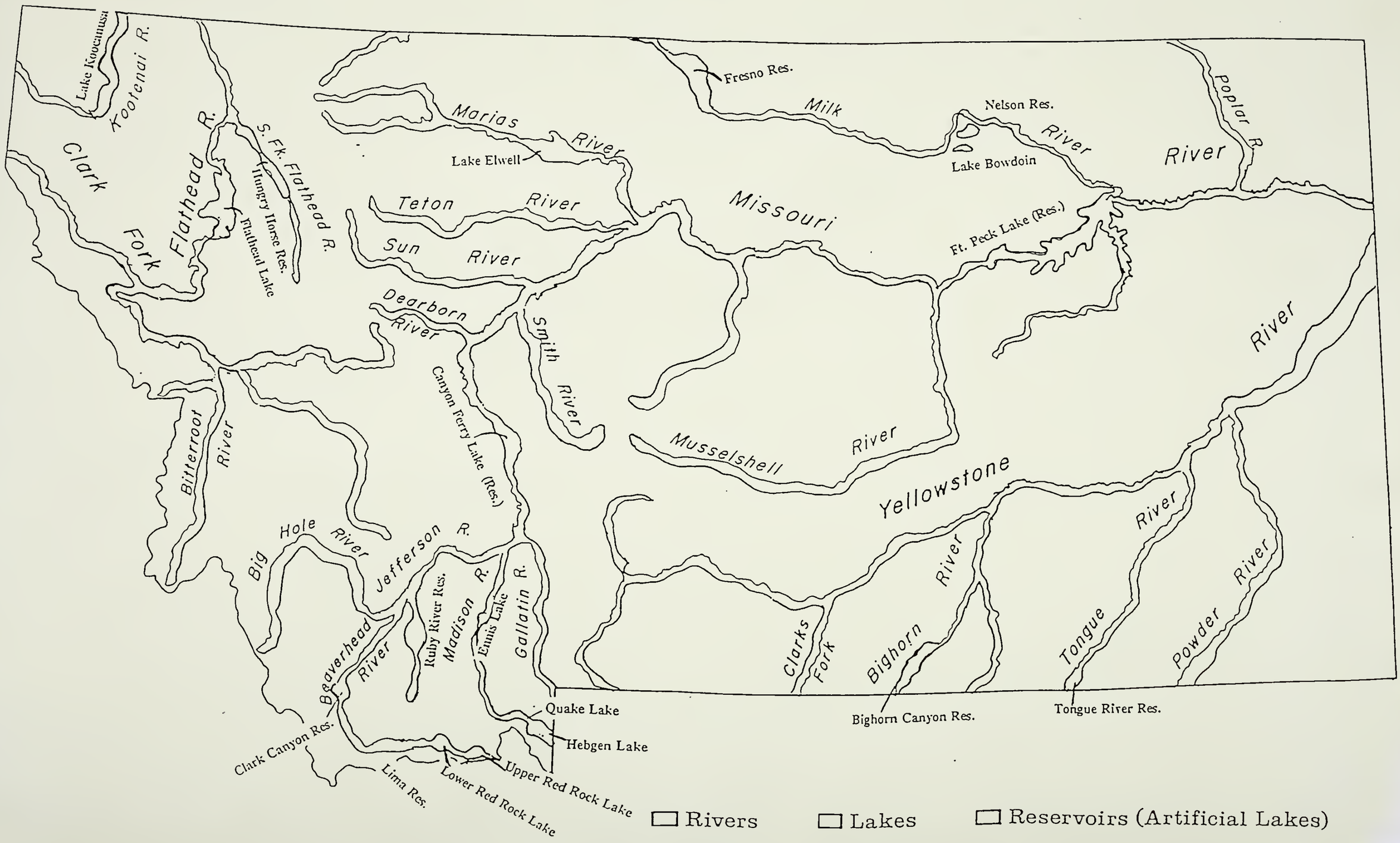
- Brushing teeth/shaving: Use water only to wet the brush and for rinsing.
- Toilet: Flush only as required; check the toilet for leaks.
- Leaky faucets: Measure overnight water loss; tighten fixtures; replace washers.
- Laundry or dishes: Wait for a full load before washing.
- Car washing: Use a bucket and sponge; hose only to rinse.
- Yard and garden: Water only as needed, early morning for least evaporation.

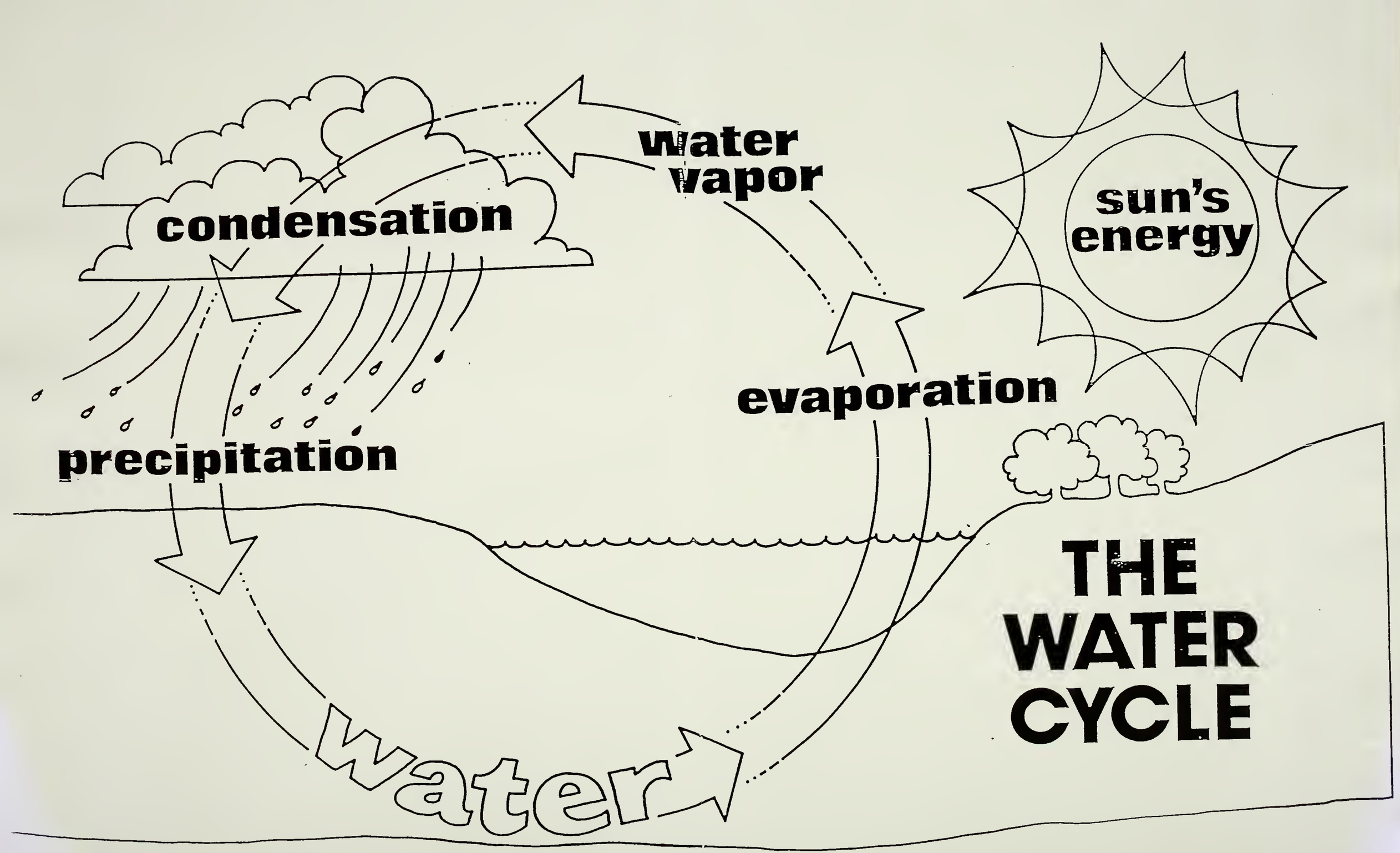
Thank you for helping to make our water study more meaningful.

A Teacher of Water Savers

MONTANA WATER RESOURCES

SELECTED RIVERS, LAKES, AND RESERVOIRS




condensation
water vapor
sun's energy
evaporation
precipitation
water
THE WATER CYCLE